

University of Bahrain
College of Information Technology
Department of Computer Science
Semester 2, 2012-2013
ITCS312/ITCS314 (Formal languages and Automata Theory)
Test-I

Date: April 1, 2013

Time: 3:00-4:00

STUDENT NAME	D R A G O N
STUDENT ID #	
SECTION	

NOTES:

- WRITE ONLY ONE SOLUTION FOR EACH QUESTION.
- SWITCH OFF YOUR MOBILE PHONES.
- THIS EXAM CONTAINS 4 PAGES.
- ANSWER ALL THE FOLLOWING QUESTIONS
- $\Sigma = \{a,b\}$ UNLESS STATED OTHERWISE

QUESTION #	MARKS		COMMENTS
1	5	5	
2	11	11	
3	14	14	
TOTAL	30	30	

Question One (True/ False) (5 marks)

1. In NFA- Λ , Λ is among Σ (False). ✓
2. If R and Φ are regular expressions then $\Phi R = \Phi$. (True) ✓
3. $(a^*b^*)^* = (a + b)^*$ (True) ✓
4. $L_1 L_2 = L_1 + L_2$ if $L_2 = \{\Lambda\}$ and L_1 is not empty and does not accept Λ . (False) ✓
5. Moore machine has always one more node than that of Mealy machine. (False) ✓

5

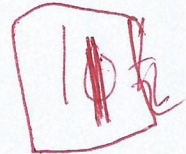
Question Two (11 marks)

Complete the following

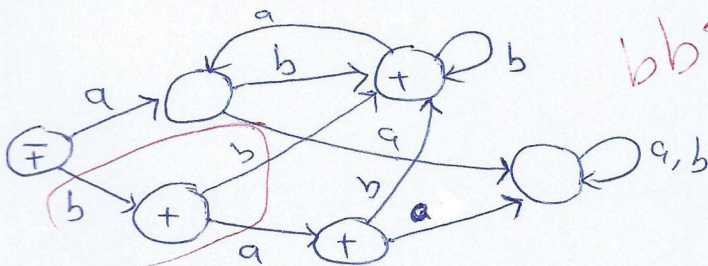
1. $(a^* + b^*)^* =$

(Give another equivalent RE) (2 marks)

$(a^*b^*)^*$ 2



2. The FA for $(ab+bb)^* + ba$ (2.5 marks)

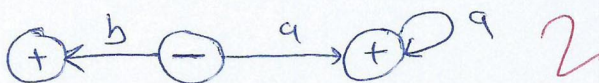


a ba abb b abb
 ab $abba$ $abbb$
 ba a ba
 b ab
 bb ab ab
 bab ab

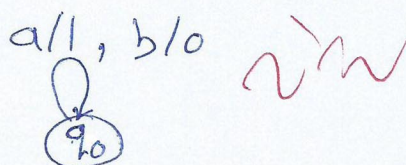
3. The RE for $L = \{a \text{ } abb \text{ } abbbb \text{ } abbbbbb \text{ } abbbbbbbb \text{ } \dots\}$ (2 marks)

RE: $a(bb)^*$ 2

4. The NFA for $aa^* + b$ (2 marks)

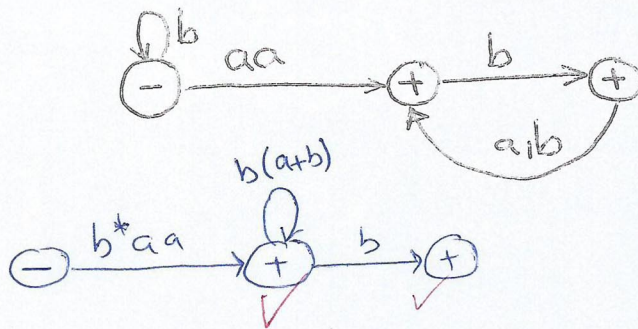


5. Mealy machine for a machine that counts number of a's where $\Sigma = \{a,b\}$ (2.5 marks)



Question Three (14 marks)

1. Given the following TG, find the corresponding RE (2.5 marks)

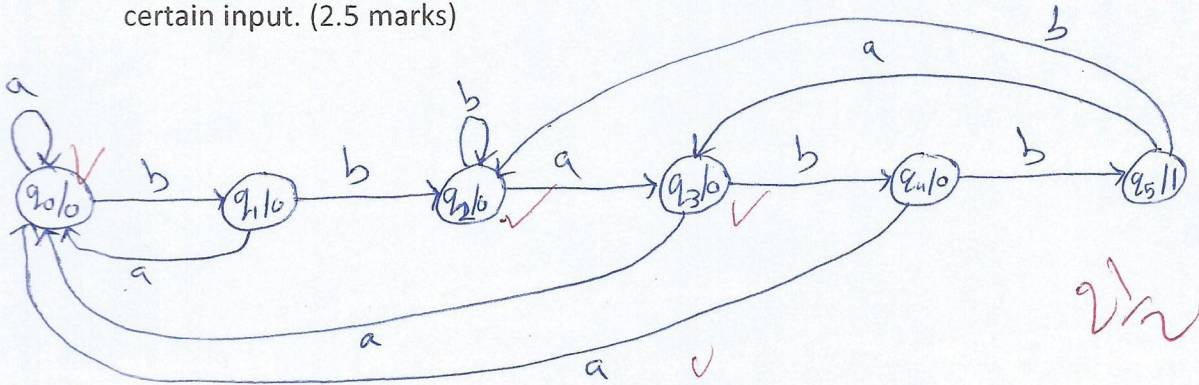


bb^*abab^*

RE: $b^*aa(b(a+b))^* + b^*aa(b(a+b))^*b$

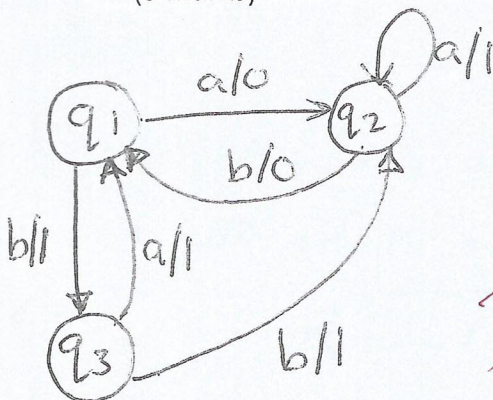
$2\frac{1}{2}$

2. Give Moore machine that counts the occurrence of **bbabb** substring in a certain input. (2.5 marks)

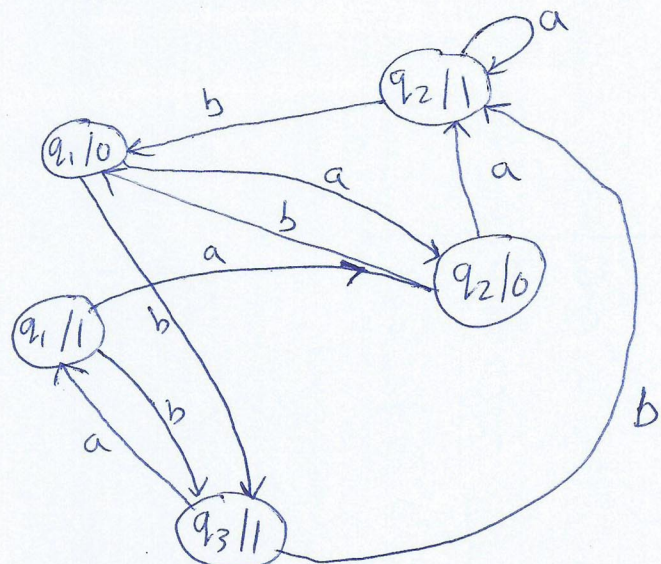


$2\frac{1}{2}$

3. Given the following Mealy machine, give the corresponding Moore machine. (3 marks)

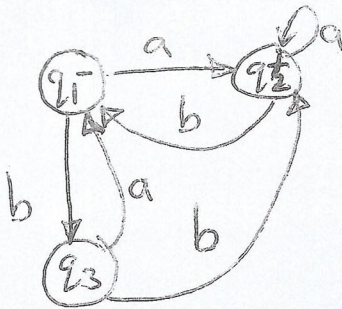


3



4. Given the following FA, find the FA for R^* , where q_1 is a starting, q_2 is a final state and q_3 is not a final state. (3 marks)

14



$$\bar{Z}_1 = q_1$$

in Z_1 if a q_2 or $q_1 = Z_2 +$
if b $q_3 = Z_3$

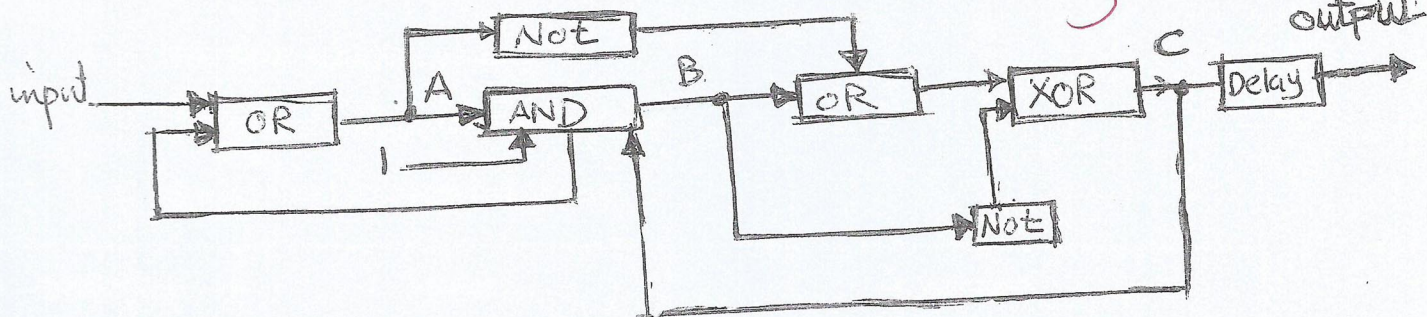
in Z_2 if a q_2 or $q_1 = Z_2$
if b q_1 or $q_3 = Z_4$

in Z_3 if a $q_1 = Z_1$
if b q_2 or $q_1 = Z_2$

in Z_4 if a q_2 or $q_1 = Z_2$
if b q_3 or q_2 or $q_1 = Z_5 +$

in Z_5 if a q_1 or $q_2 = Z_2$
if b q_2 or q_1 or $q_3 = Z_5$

5. Given the following sequential circuit, show the required formulas and states (initial) to get the corresponding Mealy machine (3 marks).



$$\text{new } A = \text{input OR } (1 \text{ AND old } A \text{ and old } C)$$

$$\text{new } B = 1 \text{ AND old } A \text{ and old } C$$

$$\text{new } C = (\text{old } B \text{ OR } (\text{old } A)) \text{ XOR } (\text{old } B)$$

$$\text{output} = \text{old } C$$

	A	B	C
q_0	0	0	0
q_1	0	0	0
q_2	0	1	0
q_3	0	1	1
q_4	1	0	0
q_5	1	0	1
q_6	1	1	0
q_7	1	1	1